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Individual differences in children's knowledge of expository text structures: A review of literature

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Abstract

In this review of literature we examine empirical research of individual differences in younger readers' knowledge and use of expository text structures. The goal of this review is to explore the influence of reader and text characteristics in order to better understand the instructional needs of elementary school readers. First we review research which has examined the influence of two textual characteristics: the hierarchical organization of macro-and micro-level propositions and the type of text structure (e.g. collection, comparison, problem-and-solution). Then we review research of three reader characteristics: overall comprehension skill, age, and prior knowledge and how their influences may vary in relation to the aforementioned text characteristics. Our review of research suggests that readers of all ages may benefit from explicit instruction in text structure, particularly less-skilled comprehenders. Text structure instruction should focus on highly structured texts like comparison, causation, and problem-and-solution.

Keywords: Text structure, structure strategy, expository text

Introduction

Informational texts can present a challenge for many elementary school readers. In comparison to narrative texts, young readers may have more difficulty comprehending expository texts (Best, Floyd, & McNamara, 2008). This difficulty is likely the result of both the demands on readers' prior knowledge (Best et al., 2008) as well as lower levels of early exposure to expository texts (Duke, 2000). An additional source of difficulty may be the structure of expository texts (Coté, Goldman, & Saul, 1998). In comparison to narrative texts, a larger number of structures are used to describe the organization of expository texts. Meyer (1975, 1985a) proposed five top-level structures: collection, description, comparison,

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causation, and response (problem-and-solution). When reading expository texts younger readers are confronted unfamiliar concepts that are organized in an unfamiliar way. Difficulties in comprehension of informational texts may lead to trouble with learning from text, particularly in content areas. In order to meet the challenge of reading these texts, readers may employ a number of comprehension processes including: paraphrasing, elaborating (connecting to prior knowledge), and monitoring (Coté et al., 1998).

Another way in which younger readers can successfully comprehend expository text is through their knowledge and use of text structure. Readers who possess a "structure strategy" have knowledge how authors organize texts and seek to apply this knowledge to the text being read, while readers without this strategic knowledge approach text with a "default/list" strategy in which the text is viewed as a collection of loosely related ideas (Meyer, Brandt, & Bluth,1980; see Meyer & Rice, [1982] for a more detailed description of the structure strategy). Readers with structural awareness possess the ability to not only recognize an author's organization, but also to engage in similar organizational processes in establishing their own mental representations of a text.

Awareness of text structure has been associated with better text recall in terms of the number of ideas remembered and their organization (Meyer et al., 1980; Taylor & Samuels, 1983). Structural awareness improves comprehension because it facilitates the construction of a coherent mental representation of text. Coherence, the creation of clear relationships between and among textual ideas contained in one's cognitive representation is considered an essential aspect of text comprehension (van Dijk & Kintsch, 1983; Kintsch, 2004; van den Broek, Young, Tzeng, & Linderholm, 2004). Readers with structural awareness develop a mental representation in which textual ideas are organized according to a defined hierarchical structure. This organization helps readers' ability to remember ideas from a text, especially those propositions at the top of the hierarchy (Britton, Meyer, Hodge, & Glynn, 1980, Meyer et al., 1980; Taylor & Samuels, 1983).

Although some younger readers possess knowledge of expository text structure (Englert & Hiebert, 1984; McGee, 1982; Richgels, McGee, Lomax, & Sheard, 1987; Smith & Hahn, 1987; Yochum, 1991), many do not (Meyer et al., 1980; Taylor, 1980; Taylor & Samuels, 1983). The extent to which children are structurally aware may vary as a function of both textual characteristics such as text structure (Richgels et al., 1987; Smith & Hahn, 1989; Yochum, 1991) as well as reader characteristics, such as age (Englert & Hiebert,1984; Englert & Thomas, 1987; Garner & Gillingham, 1987; McGee, 1982; Smith & Hahn, 1989) and overall comprehension skill (Meyer et al., 1980; Englert & Hiebert, 1984). Intervention research has shown that with explicit instruction in the use of text structure, readers can improve both structural knowledge and comprehension (e.g. Armbruster, Anderson, & Ostertag, 1987; Meyer et al., 2002; Meyer et al., 2010; Williams et al., 2005; Williams et al., 2007; see Meyer & Ray in this issue). However, there is evidence that instruction which is individualized to the instructional needs of the reader is more effective than less individualized instruction (Meyer, Wijekumar, & Lin, 2011). In order to better understand elementary school readers' instructional needs, it is necessary to have a clear understanding of sources of individual differences.

Purpose of this Review of Literature

This review of literature examines sources of individual differences in children's awareness of expository text structures. Previous reviews of literature have described the contribution of reader and text variables on the processing of text structure (e.g. Goldman & Rakestraw, 2000) as well as the interaction between reader and text variables (Roller, 1990). In this review, we investigate how sources of individual differences among readers interact with

structural properties to influence both structural knowledge and use of this knowledge in comprehending expository texts. This review differs from Roller (1990) in that we examined the relationship among multiple reader characteristics, while the review conducted by Roller focused specifically on one individual difference: prior knowledge. We take the position that structural awareness varies not only as a function of the reader but also as the reading situation changes. This view reflects current perspectives on reading which stress the importance of the relationship between reader, text, and situational variables (RAND reading study group, 2002). Our goal is to provide a comprehensive picture of students' instructional needs, by providing insights into variability of children's structural knowledge.

Reader and textual characteristics

We used the framework created by Meyer and Rice (1989) to guide the selection of reader and textual influences (see also Meyer, 2003). Meyer and Rice proposed three sources of individual differences in text comprehension: the reader, the text, and the task. Most relevant to the current review are reader and text variables. Reader variables refer to the experiences and skills that readers bring with them to the text and include: age, verbal ability, and prior knowledge (Meyer & Rice, 1989). Text variables refer to those variables which contribute to the content and organization of the text such as text structure, genre, and topic (Meyer & Rice, 1989).

Although there are several possible reader and text influences, we selected those influences which have been both frequently researched and are most relevant for instruction of elementary school readers. With regards to textual characteristics we focus on two major influences. The first is the overall quality of the hierarchical organization and the extent to which subordination of ideas is present. The second source of variability we examined is the type of top-level, rhetorical structure used to organize the text (e.g. comparison, problem-and-solution). We include in this examination of rhetorical structure empirical studies which have examined readers' sensitivity to text signaling. Text signals are textual elements (e.g. headings, overviews, previews, and connectives) which call readers' attention to the structure of the text (Meyer, 1985b; Lorch, 1989). Although this review treats these text characteristics as separate elements, these aspects of text structure are not necessarily mutually exclusive. In this review, we distinguish these elements of structure in order to more closely examine readers' knowledge of various types of top-level-structures as well as their ability to recognize the hierarchical relationships between macro- and micro-level propositions contained in the text. This review does not cover issues of cohesion and its relationship to reader characteristics (see McNamara, Kintsch, Songer & Kintsch,1996; Ozuru, Dempsey, & McNamara, 2009; Voss & Silfies, 1996). Cohesion was excluded from the current review as it covers a broader set of textual characteristics than text structure.

In relation to reader characteristics we focused on three sources of individual differences: overall comprehension skill, age, and prior knowledge. Although each of these variables has been found to influence structural awareness, the nature of this influence is somewhat different. Age and comprehension skill are associated with both the level of awareness a reader has and their ability/need to apply this knowledge. In contrast, prior knowledge is usually associated with the circumstances under which readers do and do not use knowledge of text structure. For each of these reader variables, we explore its unique contribution and how the influence of each of these variables changes in relation to the previous mentioned characteristics of the text.

This review of literature does not represent an exhaustive review of those studies which have examined awareness of text structure; rather we have selected those studies which are representative of research on the influence of reader and textual characteristics. We chose to

focus only on those studies which closely align with Meyer's (1975, 1985a) analysis and classification of expository text structures (for alternative approaches to the description and classification of text structure see Alvermann & Hague, 1989; Frederiksen, 1975; van Dijk & Kintsch, 1983). We selected Meyer's approach because several studies of younger readers' structural knowledge as well as interventions designed to teach text structure, reflect this approach. This allowed us to draw meaningful conclusions across studies. Wherever possible, we include those studies which have investigated younger (elementary and middle school) readers.

Influence of Text Characteristics

The overall quality of the hierarchical relationships between propositions within a text may influence readers' ability to perceive and use text structure. The organization of expository text is centered on the hierarchical relationship between macropropositions, higher level ideas, and micropropositions, the lower level ideas which elaborate on them (Weaver & Kintsch, 1991). When the overall organization is compromised, comprehension and recall performance are negatively affected (Kintsch & Yarborough, 1982; Taylor & Samuels,1983; Danner, 1976). Kintsch & Yarborough (1982) found that poorly constructed texts were associated with poorer performance on main idea questions in comparison to well-structured text. Similarly, Danner (1976) and Taylor and Samuels (1983) reported that elementary school readers recalled fewer ideas when reading texts that lacked a clear organization. Taylor and Samuels found the effect of textual organization was related to readers' level of structural awareness. Readers classified as structurally aware had a greater number of ideas recalled with unscrambled over scrambled text, while readers classified as unaware had a similar number of ideas recalled for both scrambled and unscrambled passages (Taylor & Samuels, 1983). This finding suggests that in order for structural knowledge to benefit comprehension, the reader must be able to perceive the hierarchical organization of the text.

Text structure

Readers' structural awareness and the benefits of structural knowledge may also vary in relation to the type of text structure being read. For adults, different text structures may have varying effects on the number of ideas recalled and their organization. Meyer and Freedle (1984) classified the five text structures described by Meyer (1975) on a continuum reflecting the number and ordering of required schematic components contained within each structure. While some structures are less structured, such as collection and description, other structures are more structured, like causation and problem-and-solution. Meyer and Freedle found that more organized structures like comparison and causation were more facilitative of recall (in terms of number of ideas and their organization) than less organized structures like collection. Other researchers have produced similar findings regarding the influence of less and more organized text structures. Sanders and Noordman (2000) and Spooren, Mulder, and Hoeken (1998) found that problem-and-solution was associated with better performance on sentence recognition tasks in comparison to a listing structure (for Spooren et al., 1998 this only occurred with texts in which the structure was marked). Similarly, Wylie and McGuinness (2004) found that the least structured text examined, generalization, was associated with lower recall of main ideas than were the more structured texts, such as comparison.

Previous research on the effect of type of structure on children's knowledge and use text structure has produced mixed findings. Englert and Hiebert (1984) compared 3rd- and 6th-grade readers' sensitivity to description, enumeration, sequence, and comparison text structures using a judgment task in which readers were asked to rate how well a list of

sentences fit with the stimulus sentences provided. The researchers found that children had better judgments with the collection structure than the comparison, with performance lowest for comparison and description structures. This difference was present on targets (sentences that fit the structure) but not distractors (sentences that did not fit the structure) (Englert & Hiebert, 1984). Similarly, in their study of 4th -, 6th-, and 8th-graders' recalls, Smith and Hahn (1989) found that comparison was used less frequently to organize recall than enumeration and description. In both of these cases, levels of structural awareness were related to the age of the readers; older readers demonstrated greater knowledge of the comparison structure, than younger readers. This relationship will be further discussed in a later section.

Other researchers have shown patterns of children's awareness that are somewhat similar to the patterns found with adults. Richgels, McGee, Lomax, & Sheard (1987) found that 6th-grade readers were more sensitive to the comparison structure than the other structures examined (collection, causation, problem-and-solution). They found that causation texts posed the greatest challenge to 6th-grade readers; performances on a matching task as well as organizational ratings of recalls and compositions were lowest for causation (Richgels et al., 1987). Similarly, Yochum (1991) found that 5th graders recalled more ideas when reading comparison texts than when reading attribution (collection) texts. However, this effect for text structure was not found on a comprehension test. These findings suggest that like adults, children may benefit from more organized text structures. However, unlike adults, children's knowledge of text structure may still be developing, and those structures that are most structured like the causation structure, may pose a challenge.

In addition to the overall rhetorical structure, textual signaling devices that explicitly indicate the structure of the text may also influence readers' abilities to recognize and use the text structure. Numerous studies which have examined the influence of text signaling on adult comprehension have demonstrated that signaling is associated with a greater number of ideas recalled and more organized recalls (Kardash & Noel, 2000; Lorch & Lorch, 1985; Lorch, Lorch, & Inman, 1993; Ritchey, Schuster, & Allen, 2008; for an extensive review of text signaling see Lorch, 1989). Research on younger readers' sensitivity to signaling reveals similar effects. Ohlhausen and Roller (1988) in their examination of younger readers' sensitivity to structural and content schemas found that texts which contained elements highlighting both the structural and content organization were associated with a greater number of correct main ideas identified in comparison to those texts which emphasized either the structure or the content. Moreover readers exposed to a text which emphasized the text structure were better able to identify the structural organization (Ohlhausen & Roller, 1988). Similarly, Rossi (1990) found that structural schemas which highlighted macrosentences and/or the overall rhetorical structure were associated with higher performance on a test of comprehension and a larger number of text propositions produced in 5th-grade readers' summaries. The effectiveness of signals has been found to vary in relation to the overall comprehension skill of the reader (Meyer et al., 1980). Nevertheless, previous research suggests that providing indices of the top-level structure of texts can facilitate readers' structural awareness by making the structure more explicit.

The Relationship between Reader and Text Characteristics

In this section, we will examine previous research which has investigated sources of individual differences (reading ability, age, prior knowledge) in structural awareness and their relationship to text characteristics. Although we will address these sources individually, many studies consider multiple reader and text influences simultaneously. Table 1 contains a

description of studies which have examined individual differences in younger readers' knowledge of text structure.

Table 1. *Reader and Text Influences on Structural Knowledge*

Authors	*Date*	*Reader*	*Text*	*Text Structure(s)*
Danner	1976	Age	HQ	Description
Taylor	1980	Age, CA		Attribution
Meyer et al.	1980	CA, SA	S	Comparison, problem-solution
McGee	1982	Age, CA		Description
Taylor & Samuels	1983	SA	HQ	
Loman & Mayer	1983	CA	S	
Englert & Hiebert	1984	Age, CA	TS	Description, enumeration, sequence, comparison
Garner et al.	1986	Age	HQ	
Garner & Gillingham	1987	Age	HQ	
Englert & Thomas	1987	Age, LD	TS	Description, enumeration, sequence, comparison
Richgels et al.	1987	none	TS	Collection, comparison causation, problem-solution
Ohlhausen & Roller	1988	Age	S	Description
Smith & Hahn	1989	Age	TS	Description, enumeration sequence, and comparison
Rossi	1990	CA	S	Problem-solution
Yochum	1991	PK	TS	Attribution, comparison
Vauras et al.	1994	Age, CA		Description, functional/causal
Armand	2001	PK	TS	Causation+collection/ casuation+comparison
Ray	2011	Age, CA	TS	Comparison, problem-solution

Note. Reader variables: CA= comprehension ability, LD= learning disability, PK= prior knowledge, SA= structural awareness level; Text variables: HQ = hierarchical quality, S= signaling, TS= text structure

Reading comprehension skill

Readers' overall comprehension abilities are associated with their levels of structural awareness. In general, previous research has found that readers classified as skilled comprehenders have greater structural awareness in comparison to less skilled readers (Englert & Hiebert, 1984; Hiebert, Englert, & Brennan, 1983; McGee, 1982; Meyer et al., 1980; Ray, 2011; Taylor, 1980).Within the same grade, skilled comprehenders recall more ideas after reading and produce recalls that more closely reflect the author's organization (McGee, 1982; Meyer et al., 1980; Ray, 2011; Taylor, 1980). In addition, Englert and Hiebert (1984) found that on rating tasks, highly skilled readers were better able to identify statements that matched the structure of the stimulus sentences and to exclude those that did not.

These findings suggest that skilled readers are more likely to have knowledge of text structure and to approach text with a "structure strategy", and as a result, they are more likely to establish a well-organized mental representation of the text. This organized mental representation in turn improves recall. However, the benefit on recall may be restricted to those ideas located at the topic of the hierarchical structure with little difference among comprehension skill groups on recall of details (McGee, 1982). This difference may reflect structural awareness, as text structure is likely most facilitative in retrieval of macro-level propositions (Britton et al., 1980). Although overall comprehension ability has been associated with greater structural awareness, the nature of this relationship remains unclear. It not clear whether greater comprehension skill causes higher levels of structural knowledge, or whether structural knowledge contributes to improvements in overall comprehension skill. Intervention research (e.g., Meyer et al., 2010) does indicate that instruction of text structure is associated with improved performance on standardized tests of reading comprehension. Thus, it is possible that structural knowledge can predict as well as affect readers' comprehension abilities.

While the relationship between comprehension skill and structural awareness appears to be consistent across text structures (Englert & Hiebert, 1984; Meyer et al., 1980), the effect of text signals may vary in relation to the overall comprehension skill of the reader. While some studies have found that both skilled and less killed readers benefit from explicit indicators of text structure (Loman & Mayer, 1983; Rossi, 1990) others have not (Meyer et al., 1980). Meyer et al. (1980) found that text signaling benefited immediate recall for readers classified as "underachievers" (readers for whom a discrepancy existed between word reading and text comprehension) but did not have an effect on readers classified as high and low comprehenders. This benefit for signaling was found for only one of the two passages students read, a problem-and-solution text (Meyer et al., 1981). There was no effect for signaling on the comparison text read.

Although Rossi (1990) found that reading text with signaling helped both skilled and less skilled readers in comparison to reading texts with no signaling, skilled and less skilled readers differed with respect to which types of signaling were most beneficial. Rossi examined the effect of multiple signaling conditions in which the presence of two types of signaling, underlining of macrostructure sentences (topic sentences) and headings which indicated the text structure, were manipulated. Skilled readers performed better with signaling only in those signaling conditions in which the macro-sentences were underlined, while less skilled readers performed similarly across signaling conditions (Rossi, 1990).

The relationship between signaling and reading ability is complex. Although text signaling may help readers to apply their knowledge of structure to a particular text, the

effectiveness of these signals is relative to the readers' need and ability to make use of them. Highly skilled readers may not need text signaling (or certain text signals) in to order apply structural knowledge, while readers with particularly low comprehension skills may have such low levels of structural knowledge that they cannot take advantage of these signaling devices.

Age

Knowledge of expository text structures and structural properties of texts may increase with age as children gain more exposure to expository texts. Studies which have compared differences in age groups' awareness of the various expository text structures have found that levels of awareness increased with age (Danner, 1976; Englert & Hiebert, 1984; Englert & Thomas, 1987; McGee, 1982; Ray, 2011; Smith & Hahn, 1989; Taylor, 1980). In general, older readers recall more ideas after reading (Danner, 1976; McGee, 1982; Ray, 2011; Taylor, 1980), produce recalls which more closely reflect the author's organization (Danner, 1976; McGee, 1982; Ray, 2011; Smith & Hahn, 1989; Taylor, 1980), and perform better on rating tasks measuring the identification of text structure (Englert & Hiebert, 1984; Englert & Thomas, 1987). This increase with age may be related to the relative ages of the readers. Ray (2011) compared 4th-, 6th-, 7th- and 9th-grade readers' awareness of problem-and-solution and comparison texts using written recalls (problem-and-solution) and main idea statements (comparison). Although structural awareness improved with age (particularly from 4th to 6th grades), fewer significant differences in performance were found among older readers (grades 6-9), suggesting that while structural awareness increases with age, there may be periods where little change occurs. Lack of change was not a result of mastery of knowledge about text structure in the higher grades because similar to Meyer et al. (1980) about 50% of the 9th-graders gave evidence for good use of the problem-and-solution text structure.

Age may also predict readers' knowledge of other structural properties of expository texts. Both younger and older readers have knowledge of how texts should be organized, but older readers may have a more sophisticated and developed sense of organization. Danner (1976) found that even with prompting few 2nd-graders could attribute differences between ill-structured and well-structured passages to the text structure, while with prompting 4th- and 6th-graders could describe the organizational differences. Similarly, Ohlhausen and Roller (1988) found that 9th-graders were more likely than 5th-graders to provide structural reasons for the selection of main ideas in an underlining task.

In their study of 3rd-, 5th-, and 7th-grader's knowledge of structure, Garner et al., (1986) asked readers to complete a paragraph recognition task (identify a paragraph) and a paragraph construction task in which readers were given a set of related and unrelated sentences. Although all readers could identify segments of text as paragraphs, construct paragraphs which included topically related sentences, and place topic sentences appropriately, there were age differences in some areas of paragraph construction. Seventh grade readers were better at excluding unrelated sentences and establishing cohesion by organizing related sentence pairs to be adjacent. In a similar study, Garner and Gillingham (1987) asked 5th and 7th graders to compose a good and bad paragraph using a set of given sentences and to provide a verbal report of their decisions. These sentences included intrusions (sentences unrelated to the topic). Seventh graders scored higher on verbal reports of topic relatedness and superordination (placement of topic sentence) (Garner & Gillingham, 1987). However, age differences in performance on topic relatedness and superordination measures for good paragraphs showed no significant differences between the groups (Garner & Gillingham, 1987). Although younger readers used superordination and topic grouping to organize paragraphs, they were less likely to report it.

Age and text structures

In addition to awareness of the hierarchical relationships between ideas, knowledge of various types of text structures may increase with age. Englert and Hiebert (1984) found an interaction between grade and text structure on distractor items (ability to determine that a sentence did not fit the structure of the stimulus sentences). For 6th-graders there was no difference in performance across text structures, while 3rd-graders had lower ratings of distractors for sequence and description in relation to comparison (Englert & Hiebert, 1984). For 3rd-grade readers, their ability to detect that a sentence did not belong varied as function of the text structure, but for 6th graders, it did not. Smith and Hahn (1989) compared readers in grades 4, 6, and 8 on oral recalls of enumeration, comparison, and, sequence and found that all readers used the enumeration and description structures to organize their oral recalls. In contrast, few 4th and 6th graders used the comparison text structure after reading comparison texts, while many 8th-grade readers did (Smith & Hahn, 1989). Overall, previous research suggests that as readers age, their knowledge moves across the continuum that Meyer and Freedle (1984) proposed with students gaining knowledge of more organized structures like comparison. These more organized structures may provide more knowledge hooks to improve processing and memory for readers who can use the structures (Meyer & Freedle).

Age and comprehension skill

Structural awareness appears to increase as children age; however, previous research also indicates that the development of structural awareness may be constrained by the overall comprehension ability of the reader. Taylor (1980) examined the recalls of 6th-grade skilled and less skilled readers as well as 4th graders. At immediate recall, 6th-grade readers recalled more ideas than 4th graders, with no difference between reading skill groups. However, at delayed recall, skilled 6th-grade readers recalled more ideas than less skilled readers and 4th-grade readers, with no significant difference between the latter groups (Taylor, 1980). Readers performed similarly on measures of organization of recall. At immediate post-test there was no difference between grades, while at delayed recall, more skilled 6th-grade readers organized their recalls according to the structure of the text in comparison to the other groups, with no significant difference between 4th graders and less skilled 6th graders (Taylor, 1980). At delayed recall only those 6th-grade readers classified as skilled demonstrated higher levels of structural awareness in comparison to the 4th-grade group.

Research on the development of text processing, has also revealed that increases with age may be related to the overall comprehension skill of the reader. In a longitudinal study, Vauras, Kinnunen, & Kuusela (1994) compared changes in text processing strategies in grades 3 through 5 for readers classified as high, middle, and low. The researchers found that all readers improved in their organization of recalls according to the text structure, but for low readers these differences were not statistically significant (Vauras et al., 1994). High and middle groups of readers improved in both local (e.g., integrating ideas found in adjacent sentences) and global coherence (e.g., integrating across paragraphs), but low readers significantly improved only in local coherence (Varuas et al., 1984). Moreover, in comparing high and low readers, Vauras et al. found that high readers made larger gains in structural processing than low readers. Taken together, these findings suggest that development of readers' structural awareness is related to their overall reading ability, while skilled readers acquire the ability to approach text with a structure strategy, less skilled readers may continue to approach text with a default/list strategy.

Other research suggests that while reading skill may predict differences within grades, it does not predict difference across grades. McGee (1982) compared recalls of skilled and less skilled 5th- and skilled 3rd-graders. McGee found that both high and low skilled 5th-grade readers recalled more ideas than 3rd-grade readers. The structure of recalls also improved across groups, with skilled 5th-graders demonstrating use of the authors' structure, less skilled readers showing partial use, and 3rd- graders showing no use of the author's structure (McGee, 1982). Similarly, Englert & Hiebert (1984) and Ray (2011) failed to find a significant interaction between reading ability and age. However, Ray (2011) did find that when the overall comprehension ability of the grades compared, in this case 6th- and 7th-grade, were not significantly different, no significant difference in performance on structural awareness measures was found, suggesting that increases in structural knowledge are related to the overall comprehension skill of the reader. Nevertheless, these findings suggest that structural awareness increases with age for both skilled and less skilled readers. Findings from the longitudinal study by Vauras et al. (1994) suggest the need for more longitudinal studies focusing on growth in structural awareness across elementary and middle school years comparing below grade-level vs. grade level and above readers.

Prior knowledge

In comparison to reading ability and age, relatively few studies have investigated the influence on use of text structure of younger readers' prior knowledge about the topic domain of a text. Readers' prior knowledge of text content may influence the extent to which readers use text structure and benefit from indicators of text structure. Research with adults suggests that prior knowledge influences processing of the hierarchical structure of expository texts (Birkmire, 1985) and the relative benefits of text signaling (Lorch & Lorch, 1996). In relation to text signaling, Lorch and Lorch (1996) found that signaling was less effective when text topics were familiar to readers, than when they were unfamiliar. This finding suggests that readers who have prior knowledge may be less reliant on cues to the text structure. In their study of prior knowledge and text structure, Wylie and McGuinness (2004) found that both low and high prior knowledge readers benefited from reading texts with more structure (comparison, sequence, classification, and enumeration) than for the least structured texts (generalization). When comparing relative performance of these more structured texts, Wylie and McGuinness found that high prior knowledge readers recalled more ideas with comparison, but there were no differences in recall across these four text structures for low prior knowledge readers. Although both groups used structural knowledge, when prior domain knowledge was low readers may have been less successful in applying structural knowledge about texts. Overall research of adults' text processing suggests that readers' application of structural knowledge is related to their prior content knowledge.

Research findings regarding the relationship between children's prior domain knowledge and text structure have been mixed. Armand (2001) examined the relationship between French 6th-grade readers' prior topic knowledge and text structure in their influence on text comprehension. The author compared the performance of readers with high and low prior knowledge on the comprehension of texts with a combined text structure of causation plus comparison (causative agent acid rain affecting numerous attributes [i.e., bark] of two kinds of trees discussed attribute by attribute with comparative signaling comparing each tree for each attribute) versus causation plus collection (causative agent acid rain affecting two types of trees with the trees discussed one at a time going through each tree's attributes before discussing the second tree and its attributes). The second presentation method was thought to be less complex and less demanding on processing. The findings were complex because they varied with the classification of questions (e.g, recall [open ended] vs. recognition

[closed multiple choice question]). The open-ended questions showed that for high knowledge students, the causation plus comparison yielded better results than causation plus collection, while the opposite was true for low knowledge students. Armand also found a significant interaction between prior knowledge and text structure for the multiple-choice questions. However, for high knowledge readers there was no difference in performance across text structures, whereas low prior knowledge readers had better performance with the causation plus collection structure. These findings suggest that prior knowledge mitigates the demands of reading texts containing two, challenging yet more organized, structures for younger readers. Yekovich, Walker, Ogle, and Thompson (1990) found that high domain knowledge (i.e., football) enabled low aptitude students to handle causal relationships and other types of inferences above what was expected based on their aptitude test scores. In the Armand study high prior knowledge enabled 6th graders to process ideas from text in the more complex causal and comparative text, while those with low prior knowledge found the complex causal and comparative text too difficult. Students with low prior knowledge could better understand the less processing intense causation plus collection with its attributes grouped in a collection related to each tree. Similar to Wylie and McGuinness (2004), Armand's finding also suggests that low prior knowledge readers may be less able apply structural knowledge when the content demands are high. The causal structure had been found to be particularly difficult with 6th graders (Richgels et al., 1987). In the Armand study with high prior knowledge, text structure differences did not matter for recognition, but only with the deeper processing needed for recall questions. Some text structures may be unfamiliar, or too difficult for a certain grade levels or knowledge or skill levels within a grade level. Both the Armand as well as the Wylie and McGuinness (2004) study discussed above suggest that with high domain knowledge, the comparison structure can be helpful for deeper understanding.

Unlike the more complex texts studied by Armand (2001), Yochum (1991) examined the effect of attribution (collection of descriptions) vs. comparison structures on 5th-graders' recall and performance on comprehension questions. Yochum failed to find an interaction between text structure and prior knowledge. Both prior knowledge and text structure predicted the number of ideas recalled, while only prior knowledge predicted comprehension test scores. Neither prior knowledge nor text structure was associated with the structure of recalls. This finding suggests that while both prior knowledge and text structure influence comprehension, prior knowledge does not moderate the effect of text structure. However, one should be cautious about drawing this conclusion because the structure of the text did not influence organization of recall. Previous studies have indicated that readers' of this age have varying levels of sensitivity to these structures (e.g. Richgels, et al. 1987).

Few studies and inconsistencies in findings make it difficult to draw substantive conclusions about the relationship between prior knowledge about text content and/or text structure and measures of structural awareness. This probably relates to the complexity of the interactions between the reader variables of domain knowledge, structure strategy knowledge with different types structures, general reading skills, and the particular text to be read as well as the task demands. Nevertheless prior knowledge may impact readers' need to avail themselves to the affordances of text structures. Additionally, the ability to apply knowledge of text structure may vary with the type of text structure used in a text (e.g., causal vs. comparative structures).

Summary of Research Findings

Previous research indicates that the interaction between the knowledge and skills of the reader and the structural characteristics of the text influences readers' structural awareness. Older readers possess knowledge of a larger set of text structures in comparison to younger readers. In developing awareness of expository text structures, readers' move from a list like/default strategy to a "structure strategy" as proposed by Meyer et al. (1980). This development of structural knowledge reflects the continuum of structural organization proposed by Meyer and Freedle (1984). Less organized structures are likely acquired before more organized and more organized structures. Previous research indicates that by 6th-grade readers demonstrate awareness of a variety of text structures (Richgels et al., 1987, Englert & Hiebert, 1984). Development of structural awareness may differ for less skilled readers, as lower overall comprehension skills may hinder these readers' abilities to acquire greater levels of structural awareness. However, additional research is needed to further explore the influence comprehension skill has on the development of structural awareness. Moreover, even if readers have structural knowledge, the content knowledge demands of a text may inhibit their ability to apply structural knowledge. Alternatively, highly familiar domains for readers may make the affordances of text structure unnecessary. Ultimately readers' ability to perceive and use the authors' structure is the result of their ability to meet both the structural and the content demands of a text.

Although many studies have examined sources of individual differences, few studies have examined multiple sources simultaneously (See Table 1). In particular, few studies have examined the influence of comprehension skill on multiple text structure structures (Englert & Hiebert, 1984; Meyer et al., 1980). Although several studies examined age differences, few studies have examined the relationship between age and comprehension skill (e.g. Taylor, 1980; McGee, 1982; Vauras et al., 1994). Only one study in this review examined the influence of age and comprehension ability on awareness of several text structures (Englert & Hiebert, 1984). Moreover, few studies have examined the influence of younger readers' prior knowledge on the use of expository texts structures (Armand, 2001; Yochum, 1991). Even though several studies have examined multiple text structures, few of these included the causation and problem-and-solution structures. None of the studies reviewed have examined the relationship between all of the sources of individual differences (age, reading ability, and prior knowledge). Additional research is needed to explore these complex relationships, using multiple text structures, particularly more organized text structures like causation and problem-and-solution as these may be more sensitive to changes in reader characteristics. A closer examination of how sources of individual differences vary across reading situations or time in longitudinal designs will provide a clearer picture of students' needs.

Instructional Implications

Most elementary school readers would likely benefit from explicit instruction in the use of expository text structures. All students, but particularly younger readers, need instruction in more organized text structures like comparison, causation, and problem-and-solution. Not only do these structures provide maximal benefits for memory of expository texts, these structures may also pose the greatest challenge to younger readers. Despite age increases in structural awareness, previous research indicates that later elementary and middle school students continue to find these structures difficult (Richgels et al., 1987; Meyer et al., 1980). Students in elementary grades may also benefit from instruction in the hierarchical structure of expository texts. Although this review did not include writing research, it appears from research which has used text construction (Garner et al., 1986; Garner & Gillingham, 1987), that younger readers may need more practice in writing expository texts.

In addition, less skilled readers are likely in the greatest need of intensive and explicit instruction in text structure, including instruction in text signaling. In an intervention study, Meyer et al. (2010) found that an interaction between type of structure strategy instruction (elaborated feedback with scaffolding vs. just giving information about correctness of answers) and reading ability (below grade level vs. grade level or above) predicted 31% of the variance in who would make large gains in competency using the problem-and-solution structure before and after instruction. Below-grade-level readers were more likely to jump from no awareness of the problem-and-solution structure to competency using the problem-and-solution structure if they received elaborated feedback with modeled responses. However, the feedback condition did not make a difference for better readers. Poorer readers improved only with elaborated feedback, while better readers improved with structure strategy instruction with both types of feedback. In general, previous research which has examined development of structural awareness, suggests that these students may fail to develop competency in structural awareness without explicit instruction. These readers may also benefit from instruction in text signaling as they may be less sensitive to these devices.

Teachers need to carefully select texts when teaching readers how recognize and use expository text structure. Texts which are well organized and clearly reflect the structure being taught will help readers to apply structural knowledge. Teachers should also consider readers' prior knowledge of the text topics. Texts which contain difficult and unfamiliar material may pose a challenge to readers' ability to apply structural knowledge. However, once readers gain greater levels of structural awareness, they should also be provided opportunities to read a variety of texts. Finally, because readers vary in their knowledge and ability to use expository text structures, it is important for teachers to assess reader's levels of structural awareness prior to instruction. Awareness studies have relied heavily on recalls, usually written. While these are easy measures to administer they may be challenging for teachers to analyze and interpret. Additional research is needed on classroom-based assessments of children's structural awareness.

Conclusion

Knowledge of text structure may help younger reader to overcome the difficulties of reading expository texts. However, in order to gain competency in recognizing and using expository text structure, many students will likely require explicit instruction. In designing effective, text structure instruction, it is important to understand the needs of individual readers. Unfortunately, the individual needs of a particular reader may not always be clear given the complex nature of the relationship between reader and text. Additional research which examines the simultaneous contributions of a variety of influences may be able to provide much needed insights into meeting the needs of diverse groups of learners.

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